A DIR preparation pulse module (e.g., a non-selective inversion pulse followed by a slice-selective re-inversion pulse) is delivered at least twice within each RR interval. In the interval between each DIR pulse module, image data is acquired for a plurality of slices (e.g., blood inverted by the non-selective inversion pulse, but unaffected by the re-inversion pulse because outside of the slices being imaged, flows into the slices being imaged, and image data is acquired near the point in time at which the blood reaches a null).

As noted in the background of the application, two publications by Song et al. had taught administering one DIR pulse module for each RR interval, and acquiring data from a plurality of slices. Two other publications, one by Parker et al. and another by Yarnykh et al., had taught administering two DIR pulse modules within each RR interval, but both publications taught that data for only a single slice should be acquired following each DIR pulse. Both Parker et al. and Yarnykh et al. were written with knowledge of the work by Song et al., yet neither Parker et al. nor Yarnykh et al. proposed acquiring data from multiple slices following each DIR pulse module. Parker et al. even openly criticized the multislice technique proposed by Song et al. because "only one of the slices imaged will have the appropriate inversion time to null the signal from the blood".

The present inventors went against this teaching, and discovered that the better course was to use a plurality of DIR pulse modules in each RR interval and to acquire data from a plurality of slices following each pulse module.

The examiner's prior art has the same teachings as the publications described in the background. Pan (US 2003/0069493) teaches the approach of Song et al. – one DIR pulse module for each RR interval, and acquiring data from a plurality of slices. And Yarnykh (US 2004/0181146) teaches the approaches of Parker et al. and Yarnykh et al. – two DIR pulse modules for each RR interval but acquiring data from only one slice for each pulse module.

And the examiner's art also taught away from the invention. In Yarnykh (US 2004/0181146), the Song et al. publications and their approach of acquiring data from multiple slices following each DIR pulse module, is fully described (paragraph 0005), and then sharply criticized (paragraph 0006):

> [0006] A common problem of the above-noted multi-slice DIR techniques is the construction of a preparative module, which includes a train of slice-selective inversions, creating unequal conditions for the evolution of magnetization of different slices, since the delay between non-selective inversion and slice-selective re-inversion depends on the actual slice number. Furthermore, the restrictions on specific absorption rate (SAR) also may preclude a further increase of slice quantity. It is especially critical for the method of Parker et al., in which the number of slice-selective inversion pulses per TR is equal to the square of the number of slices, where for example, 16 inversions should be applied for four-slice imaging.

Yarnykh proposes instead to acquire data from only one slice following each DIR pulse module (paragraph 0008).

In the face of the sharp criticism in Yarnykh (US 2004/0181146) of the multi-slice acquisition technique, it is not reasonable for the examiner to conclude that combining Pan (US 2003/0069493) with Yarnykh (US 2004/0181146) would produce the invention. Yarnykh teaches in the strongest possible terms that one should not acquire data from more than one slice following each DIR pulse module. Any combination of Yarnykh with Pan would need to take this multi-slice criticism into account. One of ordinary skill readying Pan and Yarnykh would conclude that if they are to use Yarnykh's concept of two DIR pulse modules per RR interval, they need to acquire data from only a single slice for each pulse module..

Accordingly, claim 1 is allowable over the art of record.

The remaining claims are all properly dependent on claim 1, and are thus allowable therewith. Each of the dependent claims adds one or more further limitations that enhance patentability, but those limitations are not presently relied upon. For that reason, and not because applicants agree with the examiner, no rebuttal is offered to the examiner's reasons for rejecting the dependent claims.

Allowance of the application is requested.

Enclosed is a check for the Petition for Extension of Time fee. Please apply any other charges or credits to deposit account 06-1050.

Respectfully submitted,

Date: 10/5/2006

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